Size and Scale

1a. These essential facts and concepts will be used throughout the semester, and all students should memorize them. For our purposes, approximate answers are much better than precise answers. For example, the radius of the Earth should be remembered as 6000 km, rather than 6,378 km. The unit "LY" refers to light years. Complete the worksheet from the text and this week's lectures by supplying the requested quantities *in round numbers,* and also converting each number to scientific notation. **Exact answers are not needed!**

Quantity	**Approximate Value**	**Scientific Notation**
Earth's Radius (km)		
Earth-Moon Distance (km)		
Astronomical Unit (km)		
Sun's Radius (km)		
Solar System Radius (AU)		
Speed of Light (km s^{-1})		
Length of Light Year (km)		
Milky Way's Radius (LY)		
Distance to Galactic Center (LY)		
Local Group Radius (LY)		
Virgo Supercluster Radius (LY)		
Radius of the Visible Universe (LY)		

How many times bigger is the Earth than the Moon? _____

What is the ratio between the Earth's diameter and the distance to the Moon? _____

What is the ratio between the Sun's diameter and the Earth's diameter? _____

How many times more massive is the Sun than the Earth? _____

What is a light year? _____

How many stars are within 12.5 light years of the Sun? _____

How many galaxies have been found in the Local Group? _____

1b. Scaling relationships:

- The diameter (radius) of the Earth is four times larger than the diameter (radius) of the Moon.
- The distance of the Moon from the Earth is 30 times the diameter of the Earth.

- The diameter (radius) of the Sun is 100 times bigger than the diameter (radius) of the Earth.
- The distance between the Sun and the Earth (one A.U.) is 100 times larger than the diameter of the Sun
- The distance to the nearest star beyond the Sun is about 250,000 times bigger than the distance from the Earth to the Sun.

1. If the Earth is represented by a basketball placed mid-court, what size object should represent the Moon. Give an example of an object with this size.

2. If the Earth is represented by a basketball placed mid-court, how far away should the object representing the Moon be placed?

3. If the Earth is represented by a tennis ball place on the 50-yard line, what size object would be needed to represent the Sun? Give an example of an object with this size.

4. If the Earth is represented by a tennis ball placed on the 50-yard line, how far away should the object representing the Moon be placed?

5. If a 2 meter diameter ball representing the Sun were placed in Center Circle in Ann Arbor, how far away should the Earth be placed?

6. If a 2 meter diameter ball representing the Sun were placed in Center Circle in Ann Arbor, how far away would the nearest star be? Would this distance be a) on the Earth, b) inside the orbit of the Moon, or c) outside the orbit of the Moon?

Alpha Centauri	Jupiter	Pluto
Andromeda Galaxy	Moon	Ring Nebula
Antennae Galaxy	Orion Nebula	Sombrero Galaxy
Eagle Nebula	Pleiades Star Cluster	Sun

1c. Rank each of the above objects in order of increasing distance (note: some objects may be similar in mass).

1. _____ 7. _____
2. _____ 8. _____
3. _____ 9. _____
4. _____ 10. _____
5. _____ 11. _____
6. _____ 12. _____

1d. Rank each of the above objects in order of increasing size (note: some objects may be similar in size).

1. _____ 7. _____
2. _____ 8. _____
3. _____ 9. _____
4. _____ 10. _____
5. _____ 11. _____
6. _____ 12. _____

1e. Rank each of the above objects in order of increasing mass

1. _____ 7. _____
2. _____ 8. _____
3. _____ 9. _____
4. _____ 10. _____
5. _____ 11. _____
6. _____ 12. _____

1f. Place each of the above objects on the scale below at (approximately) the correct distance on the line below.